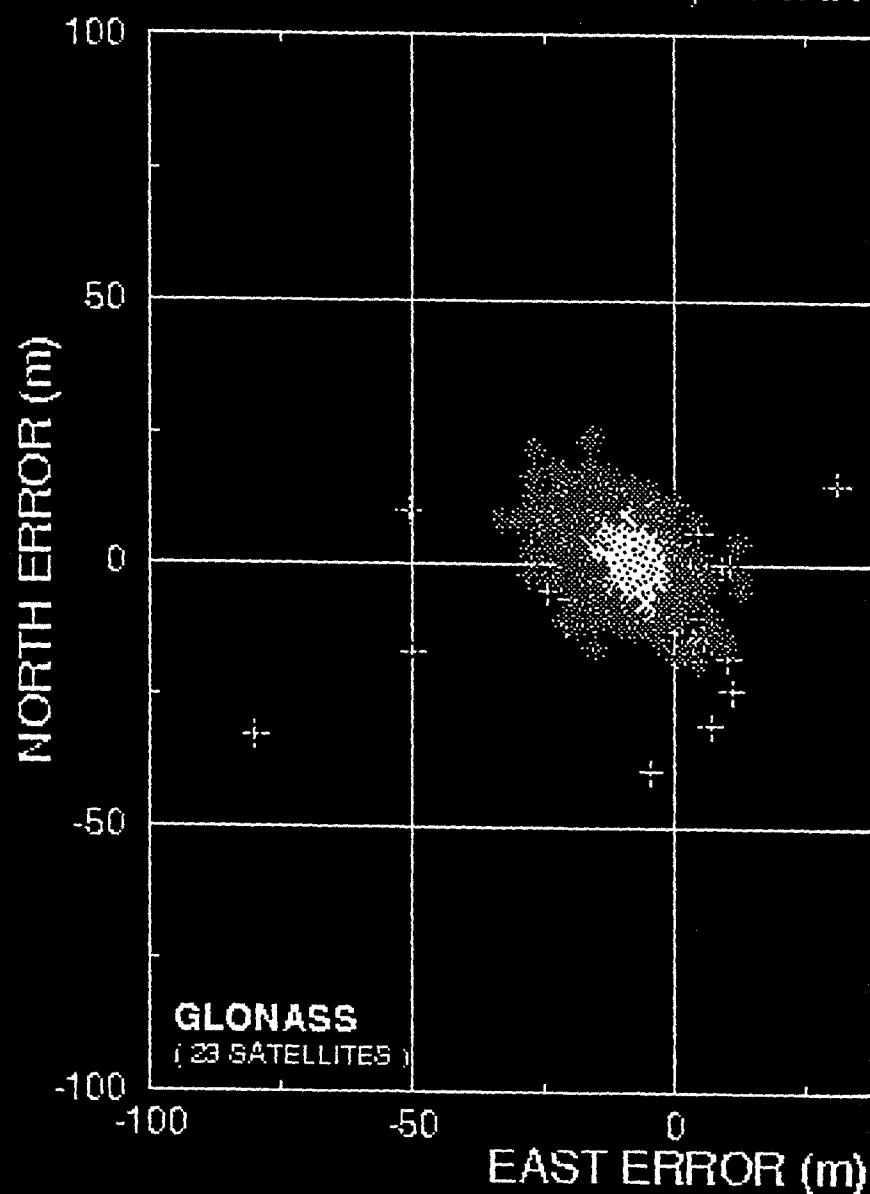


GLONASS POSITION ES

1-MINUTE SAMPLES, 23 JANU



* AT LAT: N42:27:34, LONG: W71:15:54
SEE NOTES

EXHIBIT B

THIS SEARCH**Next Hit****Prev Hit****Hit List****THIS DOCUMENT****Forward****Back****Best Sections****Doc Contents****GO TO****New Search****HomePage****Help**

H.R.1530

National Defense Authorization Act for Fiscal Year 1996 (Enrolled Bill (Sent to President))

SEC. 279. GLOBAL POSITIONING SYSTEM.

(a) **CONDITIONAL PROHIBITION ON USE OF SELECTIVE AVAILABILITY FEATURE-** Except as provided in subsection (b), after May 1, 1996, the Secretary of Defense may not (through use of the feature known as 'selective availability') deny access of non-Department of Defense users to the full capabilities of the Global Positioning System.

(b) **PLAN-** Subsection (a) shall cease to apply upon submission by the Secretary of Defense to the Committee on Armed Services of the Senate and the Committee on National Security of the House of Representatives of a plan for enhancement of the Global Positioning System that provides for--

(1) development and acquisition of effective capabilities to deny hostile military forces the ability to use the Global

Positioning System without hindering the ability of United States military forces and civil users to have access to and use of the system, together with a specific date by which those capabilities could be operational; and

(2) development and acquisition of receivers for the Global Positioning System and other techniques for weapons and weapon systems that provide substantially improved resistance to jamming and other forms of electronic interference or disruption, together with a specific date by which those receivers and other techniques could be operational with United States military forces.

SEC. 280. REVISION OF AUTHORITY FOR PROVIDING ARMY SUPPORT FOR THE NATIONAL SCIENCE CENTER FOR COMMUNICATIONS AND ELECTRONICS.

(a) PURPOSE- Subsection (b)(2) of section 1459 of the Department of Defense Authorization Act, 1986 (Public Law 99-145; 99 Stat. 763) is amended by striking out 'to make available' and all that follows and inserting in lieu thereof 'to provide for the management, operation, and maintenance of those areas in the national science center that are designated for use by the Army and to provide incidental support for the operation of those areas in the center that are designated for general use.'.

(b) AUTHORITY FOR SUPPORT- Subsection (c) of such section is amended to read as follows:

'(c) NATIONAL SCIENCE CENTER- (1) The Secretary may manage, operate, and maintain facilities at the center under terms and conditions prescribed by the Secretary for the purpose of

EXHIBIT C

To: Bob Tendler, (617) 723-7186
From: Glen Gibbons, GPS World

COMMERCE BUSINESS DAILY

Issue No. PSA-1549

Date: 03/12/96

Services

Research and Development

Synopsis# 0011 - POTENTIAL SOURCES SOUGHT

HQ Space and Missile Systems Center (AFMC) SMC/CZK, 2435 Vela Way, Suite 1613, Los Angeles AFB, CA 90245-5500

A -- GPS SYSTEM LEVEL ARCHITECTURE SOL PRDA 96-34 POC Technical Contact Point: Ms Mary Guyse, (310)363-2619; Contracting Officer: Ms CC Coleman, (310)363-6360. The NAVSTAR Global Positioning System (GPS) Joint Program Office (JPO) is seeking potential offerors for the Navigation Warfare Program (NAVWAR) to develop a systems- level solution that will PROTECT the Department of Defense (DoD) and U.S. Allies operational use of GPS during times of conflict, while PREVENTING use of GPS by adversaries. The goals of this program are to implement acquisition streamlining initiatives, reduce system costs, stimulate competition, reduce Government oversight and solve emerging requirements by stimulating and encouraging technical innovation. The objective is to achieve these goals by selecting a prime contractor to design, develop, implement, and support an integrated NAVWAR architecture. The NAVWAR program is ultimately anticipated to include three phases: Evaluation, Engineering Manufacturing Development (EMD), and Production. Funding is only available for the Evaluation phase at this time. The objective of the Evaluation Phase is to create a system-level architecture, to be developed in 1998-2000 and implemented in the 2001-2006 time frame. The Evaluation phase objectives will be met when: 1) an integrated system level architecture involving the satellite signal in space, all DoD user equipment (to include munitions), and a prevention capability are defined, 2) performance requirement thresholds and objectives are recommended, and 3) a business strategy that identifies how the system-level architecture will be implemented is provided. At a minimum, the strategy must address how, throughout the life of the system, competition will be fostered, cost reduction will be pursued and controlled, emerging technologies will be pursued and incorporated, and user equipment and prevention assets will be economically and logistically supported. This Evaluation phase will be solicited using Program Research and Development Announcement (PRDA) procedures (published approximately Apr 96). The Government may award one or more contracts for this phase and cost-sharing may be considered. Contract award for the Evaluation phase is anticipated for Aug 96 with data deliveries in Aug 97. During the Evaluation phase, the

Government will formulate a detailed acquisition strategy for the remainder of the program, including competitive source selection. The objective of the EMD phase is to develop and demonstrate prevention and protection equipment. Contract award for the EMD phase is currently anticipated for Jan 98, with a period of performance concluding in FY 2000. This is anticipated to be followed by a production phase in FY 2000 based on firm requirements. Those offerors having applicable interest, qualifications, capability and background must submit clear and convincing documentation that demonstrates their ability to meet the objectives of the Evaluation phase. Qualified offerors should possess a Secret facility clearance and approved classified material storage container(s) in order to receive and store classified portions of Government- Furnished Information (GFI). This acquisition requires the prime contractor(s) to be U. S. owned and controlled and on-shore. Off- shore subcontractors are authorized for non-restricted portions of the acquisition. Offerors must indicate whether they are a Small Business concern, use Standard Industrial Classification Code 8731 (1,000 employees). The Government will host an Industry Day on 9 Apr 96 at the Aerospace Corporation, 2350 El Segundo Blvd., El Segundo, CA 90245 to provide potential offerors with a briefing describing the NAVWAR program objectives and the acquisition strategy. The meeting will begin at 0800 in building A8, Lower Level Conference Room. Seating is limited, therefore written advance requests for admittance are required. The briefing will be Secret and only U.S. citizens will be authorized. Submit visit requests to Hester Bing, Aerospace Corporation, telephone (310) 336-5038, fax (310) 336-6983. Requests should specify NAVWAR Industry Day. An Ombudsman has been appointed to hear concerns from offerors or potential offerors during the proposal development phase of this acquisition. The purpose of the Ombudsman is not to diminish the authority of the Program Director or the Contracting Officer, but to communicate contractor concerns, issues, disagreements and recommendations to the appropriate government personnel. When requested, the Ombudsman will maintain strict confidentiality as to the source of the concern. The Ombudsman does not participate in the evaluation of proposals nor in the source selection process. The Ombudsman, Mr. Leslie Bordelon, can be reached at (310) 363-3818. Direct technical questions to Mary Guyse, SMC/CZUN, at (310) 363-2619 and contractual questions to CC Coleman, SMC/CZK, at (310) 363-6360. Written responses shall be submitted to SMC/CZK, 2435 Vela Way, Suite 1613, Los Angeles AFB, CA 90245-5500, Attn: Capt Julie Wittkoff. This synopsis is for information and planning purposes only and does not constitute a solicitation, nor is it to be construed as a commitment by the Government. The Government will not pay for any effort expended in responding to this notice. (0068)

Provided by Federal Information & News Dispatch, Inc. 202-544-4800

EXHIBIT D

THE WHITE HOUSE

**Office of Science and Technology Policy
National Security Council**

FOR IMMEDIATE RELEASE

March 29, 1996

Contact: (202) 456-6020

FACT SHEET

U.S. GLOBAL POSITIONING SYSTEM POLICY

The President has approved a comprehensive national policy on the future management and use of the U.S. Global Positioning System (GPS) and related U.S. Government augmentations.

Background

The Global Positioning System (GPS) was designed as a dual-use system with the primary purpose of enhancing the effectiveness of U.S. and allied military forces. GPS provides a substantial military advantage and is now being integrated into virtually every facet of our military operations. GPS is also rapidly becoming an integral component of the emerging Global Information Infrastructure, with applications ranging from mapping and surveying to international air traffic management and global change research. The growing demand from military, civil, commercial, and scientific users has generated a U.S. commercial GPS equipment and service industry that leads the world. Augmentations to enhance basic GPS services could further expand these civil and commercial markets.

The basic GPS is defined as the constellation of satellites, the navigation payloads which produce the GPS signals, ground stations, data links, and associated command and control facilities which are operated and maintained by the Department of Defense; the Standard Positioning Service (SPS) as the civil and commercial service provided by the basic GPS; and augmentations as those systems based on the GPS that provide real-time accuracy greater than the SPS.

This policy presents a strategic vision for the future management and use of GPS, addressing a broad range of military, civil, commercial, and scientific interests, both national and international.

Policy Goals

In the management and use of GPS, we seek to support and enhance our economic competitiveness and productivity while protecting U.S. national security and foreign policy interests.

Our goals are to:

- (1) Strengthen and maintain our national security.
- (2) Encourage acceptance and integration of GPS into peaceful civil, commercial and scientific applications worldwide.
- (3) Encourage private sector investment in and use of U.S. GPS technologies and services.
- (4) Promote safety and efficiency in transportation and other fields.
- (5) Promote international cooperation in using GPS for peaceful purposes.
- (6) Advance U.S. scientific and technical capabilities.

Policy Guidelines

We will operate and manage GPS in accordance with the following guidelines:

- (1) We will continue to provide the GPS Standard Positioning Service for peaceful civil, commercial and scientific use on a continuous, worldwide basis, free of direct user fees.
- (2) It is our intention to discontinue the use of GPS Selective Availability (SA) within a decade in a manner that allows adequate time and resources for our military forces to prepare fully for operations without SA. To support such a decision, affected departments and agencies will submit recommendations in accordance with the reporting requirements outlined in this policy.
- (3) The GPS and U.S. Government augmentations will remain responsive to the National Command Authorities.
- (4) We will cooperate with other governments and international organizations to ensure an appropriate balance between the requirements of international civil, commercial and scientific users and international security interests.
- (5) We will advocate the acceptance of GPS and U.S. Government augmentations as standards for international use.
- (6) To the fullest extent feasible, we will purchase commercially available GPS products and services that meet U.S. Government requirements and will not conduct activities that preclude or deter commercial GPS activities, except for national security or public safety reasons.

- (7) A permanent interagency GPS Executive Board, jointly chaired by the Departments of Defense and Transportation, will manage the GPS and U.S. Government augmentations. Other departments and agencies will participate as appropriate. The GPS Executive Board will consult with U.S. Government agencies, U.S. industries and foreign governments involved in navigation and positioning system research, development, operation, and use.

This policy will be implemented within the overall resource and policy guidance provided by the President.

Agency Roles and Responsibilities

The Department of Defense will:

- (1) Continue to acquire, operate, and maintain the basic GPS.
- (2) Maintain a Standard Positioning Service (as defined in the Federal Radionavigation Plan and the GPS Standard Positioning Service Signal Specification) that will be available on a continuous, worldwide basis.
- (3) Maintain a Precise Positioning Service for use by the U.S. military and other authorized users.
- (4) Cooperate with the Director of Central Intelligence, the Department of State and other appropriate departments and agencies to assess the national security implications of the use of GPS, its augmentations, and alternative satellite-based positioning and navigation systems.
- (5) Develop measures to prevent the hostile use of GPS and its augmentations to ensure that the United States retains a military advantage without unduly disrupting or degrading civilian uses.

The Department of Transportation will:

- (1) Serve as the lead agency within the U.S. Government for all Federal civil GPS matters.
- (2) Develop and implement U.S. Government augmentations to the basic GPS for transportation applications.
- (3) In cooperation with the Departments of Commerce, Defense and State, take the lead in promoting commercial applications of GPS technologies and the acceptance of GPS and U.S. Government augmentations as standards in domestic and international transportation systems.
- (4) In cooperation with other departments and agencies, coordinate U.S. Government-provided GPS civil augmentation systems to minimize cost and duplication of effort.

The Department of State will:

- (1) In cooperation with appropriate departments and agencies, consult with foreign governments and other international organizations to assess the feasibility of developing bilateral or multilateral guidelines on the provision and use of GPS services.
- (2) Coordinate the interagency review of instructions to U.S. delegations to bilateral consultations and multilateral conferences related to the planning, operation, management, and use of GPS and related augmentation systems.
- (3) Coordinate the interagency review of international agreements with foreign governments and international organizations concerning international use of GPS and related augmentation systems.

Reporting Requirements

Beginning in 2000, the President will make an annual determination on continued use of GPS Selective Availability. To support this determination, the Secretary of Defense, in cooperation with the Secretary of Transportation, the Director of Central Intelligence, and heads of other appropriate departments and agencies, shall provide an assessment and recommendation on continued SA use. This recommendation shall be provided to the President through the Assistant to the President for National Security Affairs and the Assistant to the President for Science and Technology.

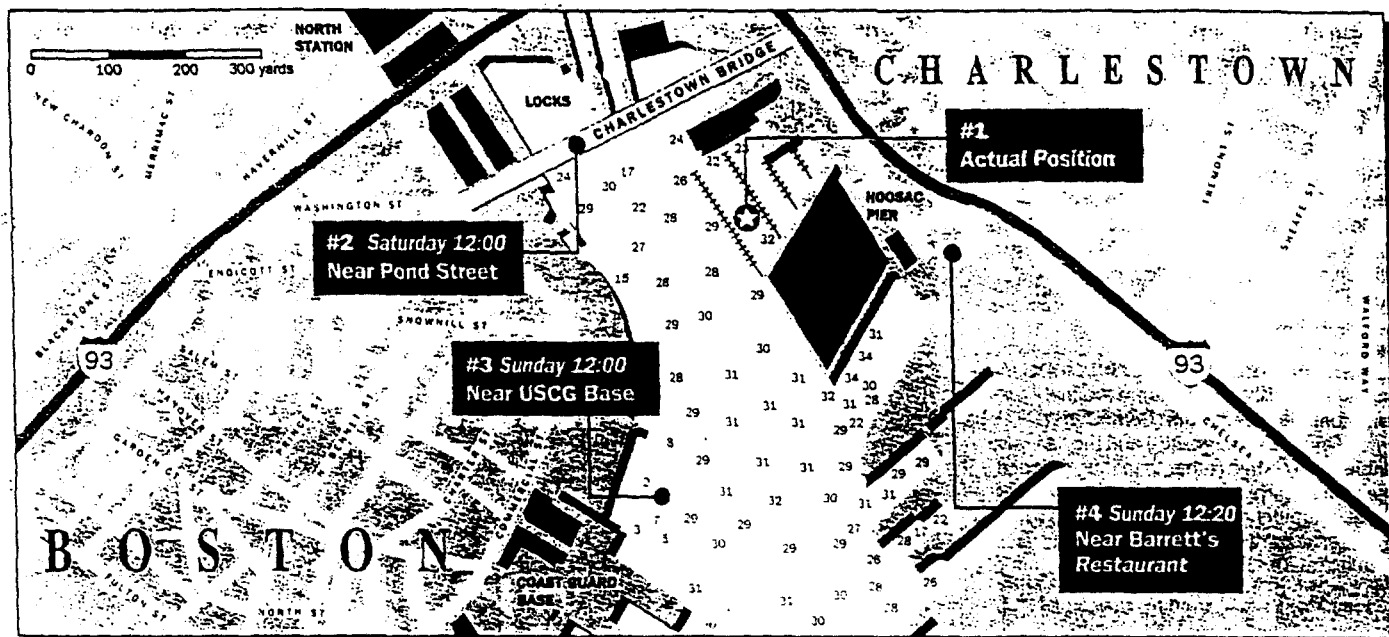
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EXHIBIT E

Opinion

by Bob Tendler

GPS: To Dither Or Not To Dither



The U.S. government may dither GPS signals as often as every two or three minutes. The positions above appeared on the author's electronic plotter over the course of a weekend at a dock near Boston, Massachusetts, demonstrating the danger of relying on dithered GPS signals when navigating in fog or near hazards.

Back in the old days of the Cold War, when Soviet intercontinental ballistic missiles were targeted on hardened missile silos in the United States, along came the Global Positioning System, or GPS. In an effort to help U.S. troops find themselves, Rockwell International and the U.S. Department of Defense decided on an ambitious program to place 24 satellites in orbit so that our country's military could conduct battles more precisely, anywhere on the face of the Earth.

The unintentional effect of providing an extensive GPS system was that it benefited not only the military, but also the citizenry at large, who had paid for the system. From cartographers to mariners to automobile drivers, GPS became a tool for the masses as much as a tool for the military.

However, with the implementation of GPS came the problem that enemies of the United States could use the system for their own purposes. Specifically, it was thought that with GPS, missiles targeted on the United States could be made so accurate as to come within 100 yards of a hardened missile silo, thereby destroying it. So in a countermeasure, the Department of Defense developed Selective Availability, in which the signals from the GPS satellites are dithered, limiting the accuracy to 300 yards as

opposed to the previous 100 yards. Selective Availability can be switched on or off at will so that U.S. forces can use the exceptional accuracy of GPS in time of battle.

Among the most influential advocates of Selective Availability were the architects of the Strategic Defense Initiative, known popularly as the Star Wars Project. Star Wars, initially conceived to intercept missiles in space, became an entity unto itself with justification based on the notion that there could be a 100-percent safety net to block an incoming missile onslaught.

Well, technology has proven to have some limitations and this was no more evident than in the Gulf War when even the best of American technology could not prevent the raining down of missiles fired by Saddam Hussein in the Middle East. So much for absolute certainty and, quite frankly, so much for Cold War logic.

Selective Availability became even more obsolete when the Russians implemented a duplicate GPS system called Glonass. Presently the Russians do not dither the signals from their satellites. Anyone who wants more accuracy than that available from dithered U.S. satellites needs only to tune a GPS receiver to the Russian GPS satellite and — voilà — 30-meter accuracy.

As for the U.S. system, it should be noted

that the GPS signal has both a fine- and a coarse-acquisition code. If civilians could get the fine-acquisition code for U.S. satellites, the error would drop to 21 meters, as opposed to 100 meters for the coarse signal. (Even that is too much error in and around harbors. Hence, differential GPS — explained below — may be the final answer.) In the meantime, 100-meter accuracy with Selective Availability presents some large problems, not only for position, but also because GPS-produced speed indications vary wildly and erratically when Selective Availability is on.

Why all the need for such accuracy in the marine environment? All one has to do is sit at the dock with an electronic plotter turned on and watch the apparent position of the boat shift rapidly in 1/5-mile jumps. As can be seen in the illustration, a boat moored at Constitution Marina in Charlestown, near Boston, Massachusetts, would find the vessel's position alternately at the Coast Guard Station across the channel, on an iron bridge that spans the outflow of the Charles River between Cambridge and Boston, or at Barrett's, the author's favorite restaurant — all of which are spaced from the vessel's real position by as much as 1/3 of a mile. If one relied on GPS to navigate when the Defense Department is dithering the signal, one

would be aground more often than not, albeit eating well.

While accuracy on the high seas may not be a problem, the general public believes that GPS can provide 10-meter accuracy. Not so with Selective Availability. Anyone who cruises in regions prone to fog would very much like to have the 10-meter accuracy. Problem is, one never knows when Selective Availability is turned on, so it is impossible to know when to rely on one's own instruments.

By way of remedy, the Department of Defense has imposed upon another govern-

where the only justification is to protect our hardened silos.

Some think that using Selective Availability will prevent cruise missiles from being able to navigate the streets of a target area. However, the Department of Defense does not use GPS position location for these missiles; rather, it relies on internal guidance systems that sense accelerations and provide the position to the cruise missile. GPS does not play a role in this guidance system.

In view of all this, it becomes increasingly clear that the federal government would be well served to give up on its dithering of the

"Dithering" is a term techies use to describe the U.S. government's policy of intentionally degrading GPS signals. This author argues that it is expensive, inefficient and in no one's clear interest

ment agency — namely, the Coast Guard — to undither the signals that it dithered. The result is a system called "Differential GPS," or DGPS. In order to do this, the Coast Guard has erected beacon stations (at a proposed cost of \$15 million) to broadcast corrective signals on a different frequency to vessels within 200 miles of the beacon. Magnavox and the Coast Guard developed GPS beacon transmitters that take the known position of the beacon and compare it with the calculated position from the GPS, thereby achieving an error between the calculated position and the known position. This error is calculated in terms of a "pseudo range number," which is then broadcast to a beacon receiver onboard the vessel. The beacon receiver corrects the pseudo range number so that the onboard GPS can accurately reflect position. Through use of a DGPS beacon, the system attains as much as a five- to 10-meter accuracy.

Another problem central to the GPS debate is that the world's charts are often inaccurate outside of the United States. For instance, some charts covering the Bahamas are based on very old surveys, the result being that charted latitudes and longitudes may differ from actual coordinates by as much as several miles. The situation is even more difficult in the Pacific, where sometimes the most accurate charts were prepared more than a century ago.

Were the Defense Department to make the fine-acquisition code available to cartographers, accuracies of +/- three meters would be possible. Even turning off Selective Availability for certain specified time periods to allow cartographers to rechart the world would help. Of course, the more rational solution would be to eliminate Selective Availability at all times there isn't a declared war going on. Oddly enough, Selective Availability was turned off during the Gulf War. It is puzzling that the Department of Defense removes Selective Availability in a wartime situation, yet insists on activating it

GPS signals. It simply costs the users too much money for a scenario that does not make geopolitical sense. Beyond the nautical realm, GPS is becoming more and more available for mobile land use; before long, all cars will have a street map display and vehicle position noted on the map. As that happens the general public will derive much more benefit from the removal of Selective Availability than the perceived military benefit of keeping it in place. From the mariner's point of view, the case for removing Selective Availability is eminently clear. Anyone who navigates in treacherous waters cannot rely on GPS in its present form. GPS receivers do not know when Selective Availability is in progress and therefore there is no way to know when to rely on one's instruments. Additionally, the world's charts lack accuracy in many places and by turning off Selective Availability for charting, one can improve navigation not only for the recreational sailor, but also for the military, which also requires more accurate charts. If this article does nothing else, it should once again indicate to sailors that one must utilize GPS with a large measure of caution if one does not equip one's boat with a differential GPS beacon receiver.

Whenever a government agency spends money on a large-scale project, the citizenry should expect an attached civilian benefit. This could not be truer than with GPS, which started out as a military project, but has an exceptionally useful civilian spinoff. For that reason, I strongly feel that Selective Availability should be used only when there is a perceived missile launch, that the Department Of Defense should make the fine-acquisition code available to the public and that the mariner should be free of dithering for dithering's sake.

Bob Tendler of Chestnut Hill, Massachusetts, is a patent lawyer and the inventor of such synthesized-voice electronic gear as the Depth Talker and the MAYDAY MIKE Rescue System. He avidly sails *Sahara Blue*, his Bristol 10, from her home port in Marblehead, Massachusetts.

CONVERSION

Published Biweekly

Guest Columnist

Stop dithering with GPS

by Robert K. Tendler

At a time when massive military expenditures are coming to an end for DOD contractors, there is one shining commercial spin-off to an otherwise totally military oriented activity. It is the Global Position Satellite (GPS) system, which now incorporates 26 satellites orbiting the earth to provide relatively accurate terrestrial position information to users around the globe.

The system was put up by the Air Force to assist in military maneuvers by providing of exact position location to an accuracy of at least plus or minus 20 meters.

But despite the millions spent on the GPS system, including its original engineering by the Rockwell Corp., the commercial spin-off applications of the system are in grave danger.

The reason is due to Selective Availability (S/A) in which the Department of Defense intentionally degrades the signal from the satellites such that an accuracy no greater than 100 meters or approximately 300 feet is obtainable. The dithering is accomplished by scrambling the pseudo range code transmitted by the satellites, which is essential to the position calculation.

DOD supposedly degrades the signal to prevent incoming Russian missiles from getting to within 100 yards of missile silos. With the demise of the Soviet Union and the concurrent threat reduction, it is apparent to all but DOD that selective availability should be shut off permanently.

It is interesting to note that if one were to instead rely on Russian GPS satellites, then all that would be necessary would be to tune the receiver to the frequency associated with the Russian satellites.

Secondly, the effect of S/A can be immediately removed by what is known as differential GPS, in which a local beacon broadcasts the correction factors to those within range.

Correction factors are determined by knowing the exact position of the beacon and adjusting the pseudo range code so that the difference in instantaneous position and exact position is transmitted as an error signal.

Since the "enemies" of the U.S. can easily generate this

error signal (Magnevox sells such a beacon) the efficacy of S/A is in question. While the absurdities of maintaining selective availability abound — especially in the post cold war era — DOD is considering turning off S/A in favor of a local jamming signal provided around strategic targets.

If this is the solution, then the commercial applications for the GPS system will flourish. First and foremost, emergency signalling will offer rescuers pinpoint location accuracy for the location of accidents, stolen cars and other emergency problems to within the originally designed 20 meters or 60 feet. But with differential GPS, there would be as much as plus or minus 2 meter accuracy.

While emergency services can cope with less precise GPS systems, vehicle tracking and on-board mapping can deal quite nicely with a 20-meter accuracy, assuming that S/A is turned off.

GPS could get cheaper

Turning S/A off opens a whole host of inexpensive commercial GPS applications. If DOD turns off S/A, taxpayers will be able to use the system they paid for.

And by turning off S/A, cartographers will be able to map areas of the world that lack accurate maps. For instance, charts in the Bahamas are often off by more than two miles due to the inaccuracy of Admiralty Charts, some of which were generated in the last century.

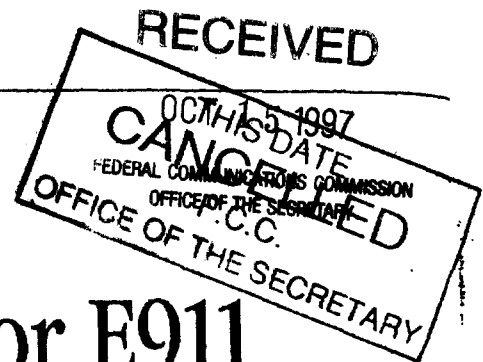
Eliminating S/A will also immediately increase the safety associated with marine use of the GPS system, which is popular with recreational boaters and sailors — and at an extremely reasonable price. In fact the street price of a non-differential GPS has already come down to under \$350, with boaters buying up GPS receivers in droves.

By switching off selective availability, the government could do an extremely good service to boaters and the community at large. At the same time it would aid conversion from military to commercial use for an important former military technology.

Robert Tendler, president of Tendler Cellular in Boston, is a patent attorney and the inventor of several GPS location systems. Call Tendler at 617-723-7268.

Cellular

RECEIVED



Subscribers Will Pay For E911

Carriers With Location Service Have Advantage

DECIBEL UNVEILS TESTING FACILITY

Site equipment manufacturer Decibel Products completed the design and installation of its facilities for environmental stress screening at the company's Dallas headquarters.

An environmental chamber produces temperature dwell and shock tests ranging from -40° to 168° F and humidity up to 95 percent. The chamber also produces snow, sleet and ice conditions.

Another system simulates heavy tropical storms and can subject equipment to rains of up to 1,000 inches per hour with simultaneous recirculating winds.

QUALCOMM TO DELIVER SAMPLES

Qualcomm Inc. announced on-time delivery of engineering samples of the next-generation MSM2300 mobile station modem chip set.

The company said its product is the fourth-generation code division multiple access-based chip set for phones, providing reduced power consumption and increased functionality.

San Diego-based Qualcomm also unveiled a new set of MSM driver, protocol stack and user interface software for the new

By Laurence Swasey
Existing and potential cellular subscribers rate enhanced 911 services as a needed service worth paying for. A recently concluded survey found E911 services also could mean the difference between using one carrier over another.

The survey was conducted by Public Opinion Strategies of Alexandria, Va., and commissioned by E911 technology provider The Associated Group Inc. of Bala Cynwyd, Pa. The company offers its TruePosition technology for carriers to comply with phase I and phase II of the FCC's wireless 911 access ruling.

"I have heard people say that it is a service they want," said Ira Brodsky, president of Datacomm Research Co. in Chesterfield, Mo. "It's not clear that consumers want a network-based service vs. a handset-based approach." With handset-based location services, such as the global positioning system, consumers could turn the feature off and on, ensuring their location is only tracked when desired.

Most people are unaware of E911 issues, said Louis Stulp, Associated's vice president and general manager. Once the public is

aware of a cellular phone's limitation in regard to 911 services, interest in location services is created, he added.

"Cellular users and potential users overwhelmingly feel that wireless enhanced 911 with emergency location capability is an important and valuable service, and they are generally (62 percent) not aware that 911 operators do not know the caller's location today," the report said.

Many existing and potential users said the location service would be seen as a competitive advantage in the marketplace. Overall, consumers were more likely to switch to the carrier that offered the technology, Stulp said.

According to the report, "If one carrier offers emergency location service for a mandatory fee and a competing carrier does not offer the service, the carrier offering the location service with a mandatory fee will have a potential net customer gain of 32 percent if the fee is \$1 and a potential net customer gain of 25 percent if the fee is \$1.50."

With a \$1 mandatory fee, more potential customers (88 percent) said they would move toward the service rather than from the ser-

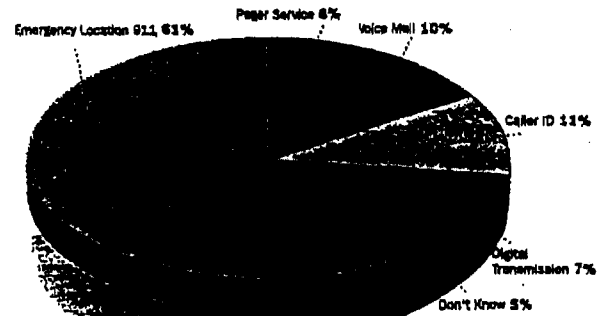
vice (20 percent). With a \$1.50 mandatory fee, potential customer movement was greater to the service (84 percent) than movement from the service (30 percent).

In addition to requesting the ser-

vice (\$3.62 vs. \$2.92). Those who are not currently cellular subscribers were willing to pay more for the service than those currently subscribing (\$4.52 vs. \$2.81).

Out of the 800 surveyed in late

Which Is The Most Important Service?



SOURCE: Public Opinion Strategies

vice, users also are willing to pay for it, the report said. "They are willing to pay an average of \$3.30 to obtain emergency location service, and rank the service as more important than many other features currently offered by carriers, including caller ID, voice mail, paging and digital."

Women were willing to pay more for the service than men

July and early August, 558 were cellular users while 242 were not. A random digit dial screening for current and potential subscribers was used, and the study results have a margin of error of plus or minus 3.46 percent in 95 out of 100 cases. The sample was the same size as The Strategis Group Inc. used when surveying for a study on E911 pricing March. ■

AT&T Wireless' Fraud Battle Escalates In Three Markets

By Laurence Swasey
AT&T Wireless Services Inc. upped the ante in its fight against fraud, adding radio-frequency fingerprinting in select markets. The company saw dramatic results in its New York City efforts after deploying RF fingerprinting software to complement other anti-fraud technologies in-

kets as needed, Corsair spokesman Bill Taliaferro said.

Despite the nationwide contract, the technology will be deployed only in select markets—Las Vegas and Fresno and Sacramento,



Calif.—because competitors in those markets, AirTouch Cellular and GTE Wireless, have deployed RF fingerprinting, said Roseanna DeMaria, vice president of security for AT&T Wireless. If AT&T Wireless did not offer the additional fraud protection, the company would not be competitive, DeMaria said. "It is important to deploy it where the competition has." She

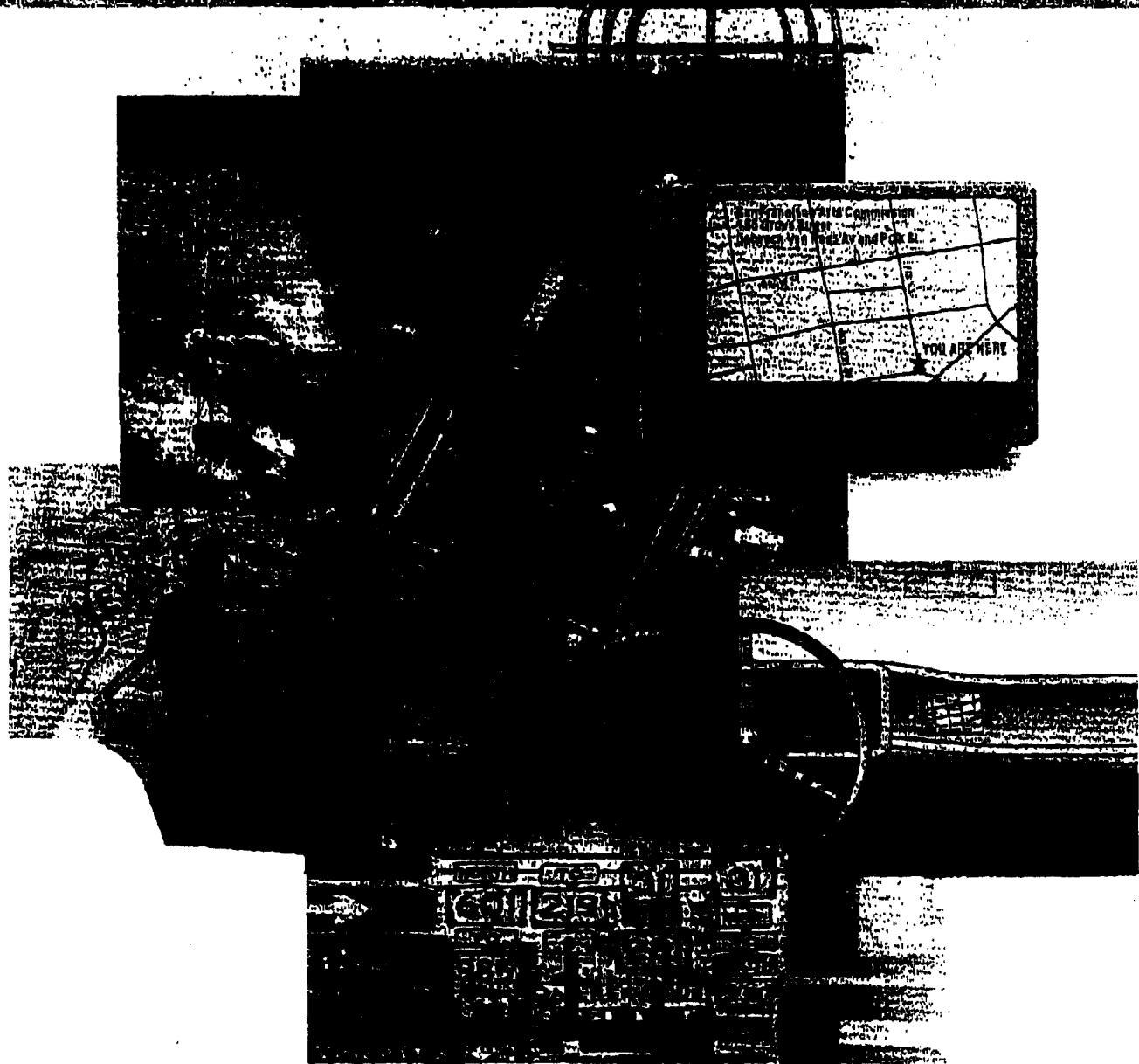
printing] in the same fashion."

Although AT&T Wireless would not state on how many cell sites the site-resident technology would be placed, DeMaria did say it was practical to place the technology on one-third of all cell sites within a market.

The combination of RF fingerprinting, authentication and other technologies in New York City helped cut fraud dramatically in "the crime capital of the world. We are still enjoying a 90 percent reduction" in fraud in New York City, she said.

RF fingerprinting technology is based on the fact that no two hand-

WIRELESS LOCATION SERVICES: 1997



- Impact of wireless E911 ruling
- Location technologies and company profiles
- Application and market sizing
- Demand analysis for location services/equipment



THE STRATEGIS GROUP

Formerly MIA-EMCI

Wireless Location Services:

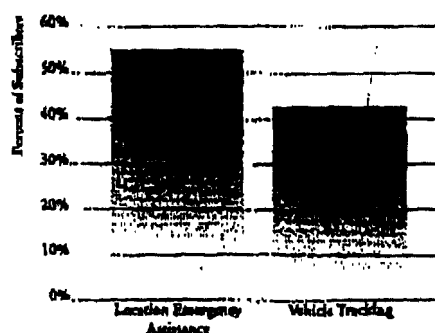
Wireless location services will see a surge of activity in 1997 and 1998 due to initiatives from LMS licensees (902-928 MHz) and industry reaction to the FCC's recent E-911 ruling. Firms such as Teletrac, Inc. are deploying radio-location systems which offer a variety of business and consumer location services. At the same time, the FCC's E911 Report & Order will accelerate the development and deployment of location technologies on cellular, PCS, and ESMR networks by requiring carriers to locate subscribers to within an accuracy of 125 meters by the year 2001. Research by The Strategis Group finds that carriers can substantially enhance their revenues and subscribers by deploying location services for a diversity of commercial applications.

In order to analyze demand for location services, The Strategis Group conducted focus groups, mall intercept interviews and telephone surveys among both business and consumer groups with respect to interest levels, likely adoption rates and willingness to pay for location-based information services. The Strategis Group's

research illustrates that the following applications have the largest commercial demand:

- Roadside assistance and vehicle recovery systems
- Asset tracking and fleet management
- Navigation and traffic information
- Electronic Yellow Pages
- Personal location and tracking

Interest in Location Services Among Cellular Phone Subscribers



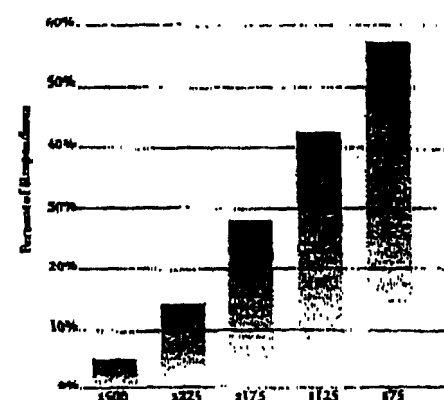
Approximately one-half of cellular users (54%) expressed an interest in having a location capability integrated with their cellular telephone, and 42% indicated an interest in a vehicle tracking and recovery system. Subscribers indicated a willingness to pay an average of \$8 - \$9.50 more per month, respectively, for these location services.

The business community expressed a considerable interest in a pager-sized device which could provide location-

specific messaging and information services. The Strategis Group found that the purchase probabilities of business professionals increased to 42% when the equipment price was \$125. When the service price was varied, business professionals showed the largest increase in purchase probability between \$20 and \$16 per month.

Demand for location infrastructure equipment will total over \$3.5 billion. A number of manufacturers are vying for this business, with no clear leader in sight as of yet. This study reports on all of the location manufacturers and service providers with equipment which is available today or in the near future.

Purchase Intentions for Location-Based Messaging Device at Different Equipment Costs - Business Users



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INTERNET GROWTH IN ASIA

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Internet usage, markets and significance are likely to grow faster in Asia than in the U.S. and Western Europe. As a communications and information medium, the Internet will make a greater impact on the lives of Asians than on Americans and Europeans.

In the U.S. and several European countries, the Internet is beginning to compete for consumers' attention and time with cable and satellite TV services which provide 50 to 150 channels of entertainment and information programming. For the past ten years, the typical American adult has been watching over four hours of television a day, selecting from and surfing among a proliferating multitude of cable & satellite channels.

In Japan, Korea, Singapore, Hong Kong, Taiwan and upper-class strata of other, less-developed Asian nations, multi-channel cable & satellite television is in its infancy, and it has neither the importance nor the ubiquity of multi-channel television in the U.S. and in a few European nations. Affluent Asians are not as addicted to TV as Americans and Asians have much less choice and variety of television programming than Americans. Therefore, the Internet in Asia will perform a relatively more significant role in informing and even entertaining Asians than in America and Europe.

MTA-EMCI's latest industry report, *Asia-Pacific Internet & Interactive Services*, investigates the growth and development of the Internet in developed and developing Asia-Pacific countries. MTA-EMCI combines on-site data collection and research with in-house data bases

Continued on Page 3

CELLULAR AND PAGING BENCHMARKS

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Although the days of tremendous subscriber growth for cellular and paging operators appear to be fading, dramatic year-to-year changes in financial benchmarks continue to play out. The impact in recent years of slowed subscriber growth and declining revenue per subscriber on the operating statements and balance sheets of these wireless operators is traced in MTA-EMCI's *Financial Benchmarks in the Paging and Cellular Industries: 1996*.

Cellular and Paging Benchmarks

In both the cellular and paging industries revenue per subscriber fell over the past few years. For cellular, the enrollment of lower-use market segments caused monthly service revenue per subscriber to decline from \$78 in 1991 to \$58 by June 1996. In this same period, paging monthly revenue per subscriber dropped from \$15.13 to \$9.50 as

Continued on Page 4

E911 - REGULATORY BURDEN OR HIDDEN OPPORTUNITY

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The FCC's E911 Ruling is a far-reaching regulatory action affecting the wireless industry. The rulemaking requires cellular, PCS, and ESMR operators to provide the location of their mobile users within an accuracy of 125 meters within 5 years. While many cellular, PCS and SMR carriers are fighting to relax what they see as a regulatory burden, MTA-EMCI believes that the ruling actually represents a hidden opportunity for the wireless industry to capture revenues from non-E911 location services.

The E911 rulemaking was initiated due to the problem of 911 operators who were unable to direct emergency assistance to mobile users because of lack of information. In 1996, there were over 50,000 calls/day to 911 from wireless phones. In many cases, delays in sending assistance or inability to send assistance were caused by the user not knowing or not able to describe where they were calling from. For 911 calls from a landline phone, this is not a problem as the user's location is usually automatically sent to the 911 operator through a central database number look-up.

While the FCC's ruling only applies to 911 calls, the benefits of location service, however, are readily appreciable and in demand by wireless and non-wireless users. MTA-EMCI has conducted extensive research into the feasibility of commercial wireless location service. Leading applications for consumers and businesses are:

Continued on Page 6

E911 - REGULATORY BURDEN OR HIDDEN OPPORTUNITY

Continued From Front Cover

- fleet management
- roadside and non-911 emergency assistance
- navigation and traffic information
- electronic Yellow Pages
- vehicle recovery service
- asset tracking
- personal and pet tracking

With the exception of roadside emergency assistance, most applications would not necessarily require voice communications and could be done through a separate messaging device, a smart phone, or a small "tag" attached to a person, car, etc. Another benefit of providing location services is that most applications would add minimal amount of traffic to an operator's network but could generate high revenues per month as detailed below.

Surveys of cellular and non-wireless users show strong demand for applications such as emergency assistance and vehicle recovery service. Over 40

percent of cellular users would desire a location service for vehicle tracking and recovery and would pay over \$11 per month for such a service. Interest in location service combined with a cellular phone for emergency situations attracted over 50 percent of cellular users and over 40 percent of non-wireless users. The average amount the users and non-users were willing to pay for this type of enhanced cellular service was approximately \$8 more than the cost of regular cellular service. Clearly, location services are valued very highly by cellular users and non-users alike and could be a large potential source of additional revenue.

Aside from demand issues relating to the demand for location services, a wireless carrier has to decide what type of technology will meet the FCC's objectives as well as meet its own strategic marketplace objectives. There are three major technical options for wireless carriers to meet the FCC's location goals:

- handsets using GPS technology
- terrestrial-based location network which is not associated with the operators' existing network
- terrestrial-based location network which uses an operators' existing infrastructure

While careful cost analysis and functionality trade-offs have to be made,

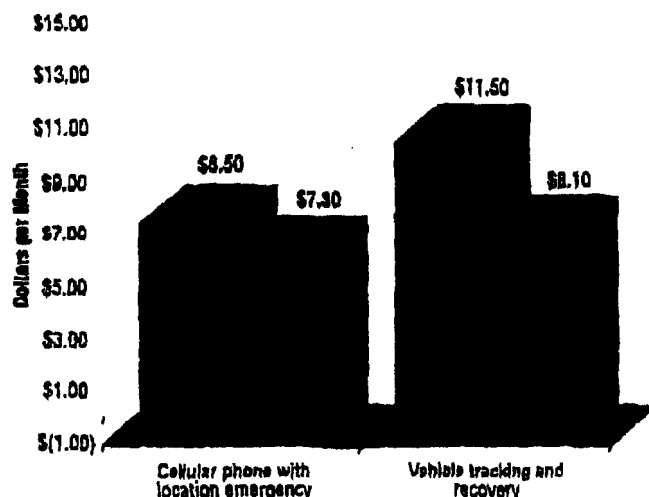
MTA-EMCI believes that wireless operators would be best served by incorporating location-based technology within their own networks. One reason is that by using their own network, location ability can work for the existing installed base of customers' handsets. The first two options would necessitate using new handsets having GPS or another systems' technology built into them. In addition, GPS may require a different antenna design which may not be well received by the marketplace.

Most commercial location services, such as vehicle or asset tracking, electronic Yellow Pages and navigation, require software and related customer support services. MTA-EMCI believes that the associated software and customer care systems will be critically important and will be what differentiates one carrier's location-based services from another. Carriers should spend considerable resources and time to ensure that once they have location-ability, they can take maximum advantage of it.

As the wireless industry experiences steadily declining revenues per subscriber from standard voice service, operators may find that the FCC's E911 ruling is just what the finance doctor ordered to allow them to tap into a entirely new revenue stream which will bolster existing subscriber revenues and bring in new subscribers. ■

Amount Willing to Pay for Location Services

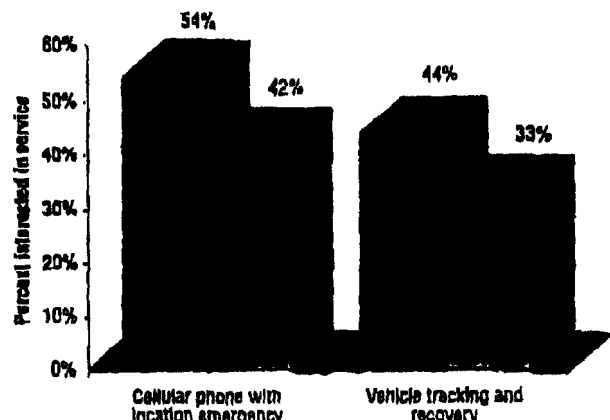
■ users ■ non-users



Source: MTA-EMCI

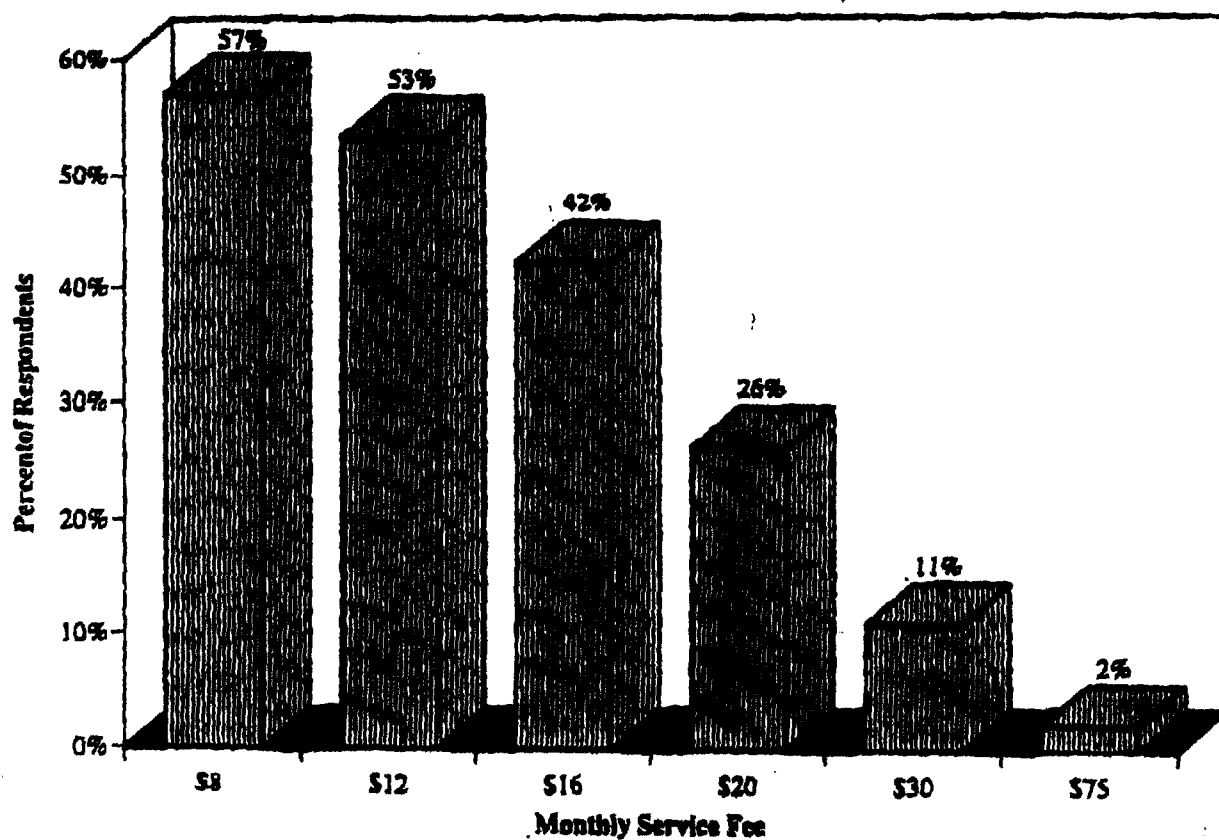
Interest in Location Services

■ cellular users ■ non-users



Source: MTA-EMCI

Figure 1.3 Purchase Intentions for Location-Based Messaging Device at Different Monthly Service Fees, All Business Groups



Source: The Strategia Group

1.3 Interest in Wireless Location Services - Consumers

The Strategis Group measured consumer interest in location-based services separately from business interest because of the different communication needs and purchasing processes of each group. This section examines consumer interest and purchase intentions for the following wireless location services:

- personal tracking,
- location-based information and navigation services through a portable device,
- child location services through a portable device,
- emergency location services, and
- vehicle/car tracking

1.3.1 Personal Tracking

Mall intercepts tested consumer interest in a service which could determine the location of a person who was wearing a portable wireless device. Upon placing a call or a page to a user of this device, a digital voice would announce the location of the user to the nearest street intersection of the person with the device. Approximately 81% of wireless users and approximately 65% of non-users showed some degree of interest in this service.

The willingness to pay for a personal tracking service varied significantly among the respondents, with a low of \$0 per month and a high of \$60 per month. The average amount willing to pay, however, did not vary significantly among the different groups of mobile communications users. Cellular users who said they were interested in this service expressed a willingness to pay \$13.20 per month, on average, while paging users were willing to pay \$12.10, and non-mobile users were willing to pay just \$9.10 per month (Figure 1.4).

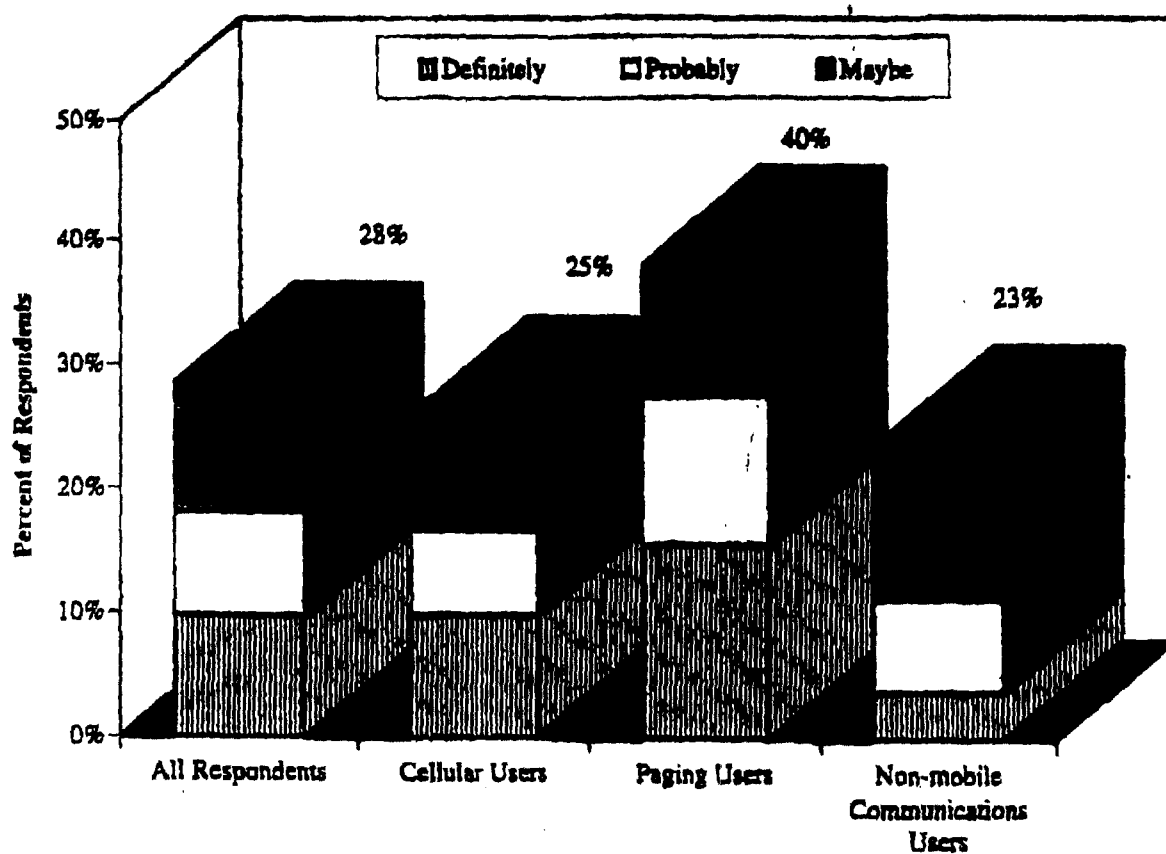
1.3.2 Location-Based Information Services

When asked to rank their interest in the separate location-based services on a scale of 1 to 10, navigation services received the highest score from cellular, paging and non-wireless users with all groups expressing a 7 or higher score. The Strategis Group found that paging users demonstrated the greatest interest in location-based information services at nearly 40%, while approximately 25% of cellular users and 23% of non-users showed some level of interest (Figure 1.5).

Respondents who expressed an interest in location-based information services said that they would be willing to pay \$13.20 per month, on average, for this service (Figure 1.6). Non-mobile communications users were willing to pay \$13.60 per month, followed by cellular users at \$13.10 and paging users at \$12.80.



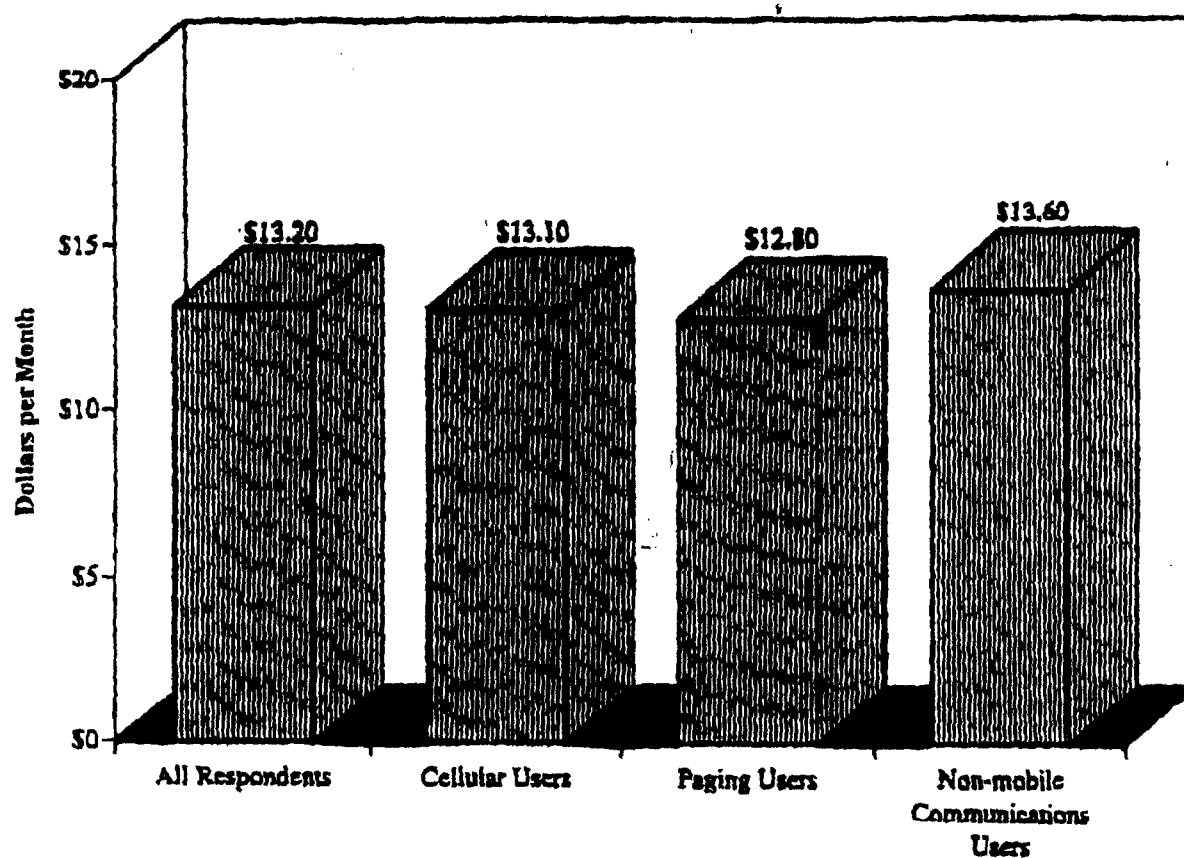
Figure 1.5 Interest in Location-Based Information Services by Current Mobile Communications Use



Source: The Strategis Group



Figure 1.6 Amount Willing to Pay for Location-Based Information Services Among Potential Users of the Service



Source: The Strategis Group